Black creek plan

1956

CONSERVATION BRANCH
ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT

DEPARTMENT OF PLANNING AND DEVELOPMENT

THE HONOURABLE W. M. NICKLE, MINISTER

A. H. Richardson
Chief Conservation Engineer

BLACK CREEK PLAN

1956

Toronto
1956

Letter of Transmittal

April 12, 1956

Mr. A. M. Greenaway,
Chairman,
Credit Valley Conservation Authority,
120 Cumberland Drive,
Port Credit, Ontario.

Dear Mr. Greenaway:

I take pleasure in transmitting to you herewith a Little Valley Study on Black Creek, one of the tributaries of the Credit River, for the purpose of encouraging the farmers and landowners in this valley to carry out a complete conservation program in the area, which might in future years serve as an example to other parts of the watershed for programs of a similar kind.

I would ask that you transmit this report to Mr. Alex MacLaren, Chairman of the Farm Planning and Land Use Advisory Board, for the consideration of his Board in particular; and assure him that we will give whatever help we can in assisting his Board to carry out this program in the name of the Authority.

Yours very truly,

A. H. Richardson
Chief Conservation Engineer

C R E D I T V A L L E Y

C O N S E R V A T I O N A U T H O R I T Y

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BLACK CREEK (CREDIT) LITTLE VALLEY REPORT

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RECOMMENDATIONS

STATED OR IMPLIED IN THIS REPORT

1. That the Conservation Authority by publicity, education and leadership promote co-operation between farmers and the Soils Advisory Service of the Ontario Department of Agriculture in planning farms for soil and water conservation. p. 49

2. That the Authority establish liaison with the owners of the gravel pit at Caledon so that the two bodies can work together in the redevelopment of the area as the deposits are exhausted. p. 50

3. That the Authority aid, insofar as is possible, in the establishment of farm ponds, the removal of stone piles and any other works calculated to forward soil and water conservation in the area. p. 49

4. That the Authority endeavour to arrange a program of private land reforestation and to assist landholders in such a program where possible. p. 45

CHAPTER 1

INTRODUCTION

1. Little Valleys

Before the future development of any area can be planned it is essential that an inventory be made of its resources and present use. This applies equally to a watershed or any other selected planning unit. Too, it is necessary that the people living in such an area express an interest in a program of this kind and be willing to co-operate in its effectuation. This is especially true of a conservation program, the aim of which is the enrichment of all by the provision of more food from the same or fewer acres and the correction of land abuse.

Few people would think of deliberately abusing their car, their family, or their home; yet many do it to the land from which the substance of their prosperity comes. By no means all of this land abuse is deliberate, of course; much, perhaps most of it, is inadvertent. Year by year there is a growing awareness of the situation, and thinking men everywhere are arousing interest in their respective communities concerning it and are trying to deal with the problem. They are being aided by many branches of government and by private bodies.

It has been recognized on the Credit Watershed that many problems exist respecting the best use of its lands and resources; a Conservation Authority for the valley has been created to deal with them. Conservation of resources is a problem in planning and requires such organized bodies to deal with it. At the Authority's request, and with a view to providing it with basic information on which to erect a program of work, the Conservation Branch of the Department of Planning and Development made a reconnaissance land use survey of the Credit Valley in 1954.

While such a survey is essential, it is often incomplete from the point of view of a local action program. In certain respects a watershed the size of the Credit is often too big to deal with at once and it is frequently desirable to select a smaller area in which the people can co-operate to improve the conditions of their local stream and its tributary lands. At the request of the Credit Authority such a stream, the Black Creek branch, was selected and surveyed in the summer of 1955 by the Conservation Branch.

A program of little valley improvement requires the active support of all the people living within its confines. As indicated previously, the improving of one little valley has a number of advantages. In the first place the results of such action as is taken can be shown directly, partly in better production from the land and partly in improved flow of the stream which is shared by all. Secondly, the accumulated effect of conservation measures is greater when they are applied on neighbouring properties. Thirdly, as new methods or ideas are introduced they can be applied to an area rather than to isolated farms. In this regard economy of operating and installation is often possible and the people are more able to pool their skills and effort to help each other. A task shared is a task made easy. Fourthly, it is often possible to obtain or use special machinery only when the members of a group work together; tree-planters and graders for grassed waterways might perhaps be cited as examples.

However else it may be regarded, the application of conservation measures to an area large or small should not be regarded as a simple "get-rich-quick" scheme. To rectify the results of 150 years' practice takes time, more in some fields than in others, and requires continued, methodical application of sound ideas and practice. Wise use of the soil so that erosion is reduced to nature's rate and fertility increased to beyond the point that nature furnished requires diligence and watchfulness. It is all to easy to be neglectful,

yet the dividends to be reaped from proper application of effort as compared to improper are immeasurably greater. Benefit descends not alone on the individual but also on the community at large.

2. The Black Creek Drainage Basin

The Black Creek Valley lies in the north-eastern section of the Credit Watershed and is found wholly within the Township of Caledon. The watershed is more or less rectangular in shape and is so oriented that the long axis runs north-east - south-west. The stream joins the Credit at a point about 1½ miles north of Cataract. The watershed is approximately 6½ miles long by 4 miles wide and contains about 13,400 acres.

In elevation the area ranges from about 1,525 feet above sea level on the north to 1,275 feet above sea level at the junction with the Credit. The main stream flows rather north-easterly, and to the south of Caledon, to a point in the Fourth Concession south of the Caledon sideroad. Here its course becomes more north-westerly. Most of the tributaries flow in from the northern side and most, even though many claim swampy land as their source areas, are dry through much of the summer. Curiously, and a reflection of the sandy, gravelly soil material, few streams enter from the southern side. Much of the main stream itself has a dry bed in late spring or summer.

Caledon, the only community within the watershed, is situated west-centrally on No. 10 Highway. Orangeville lies about 6½ miles to the north-west and Brampton about 17 miles to the south-east. Both towns are located on the same highway. Apart from agriculture and associated services the only industry found is concerned with extraction of sand and gravel, mainly from the parent material of the soil mapped as Caledon gravel.*

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* Soil survey of Peel County. Report No. 18 of the Ontario Soil Survey.

3. Soil and Water Conservation

Soil and water conservation has been defined as "the use of every acre according to its capability and its management according to its need". In a general way this is followed in ordinary farming practice. Excessively hilly and steep land or wet land is often uncultivable economically. In such cases unimproved pasture or forest is often the only possible use. This land may, then, be used according to its capability although its management may often leave something to be desired. On the cultivable lands, the capability may not be so apparent to the average person but it is imperative that these lands be used wisely. On the Black Creek only 60 per cent or so of the land can be considered capable of sustained cultivation and less than 8 per cent with no restrictions as to use.

Although much of our land may be cultivable, its quality in terms of its ability to produce good crops and good animals may be limited. Many of our acres are used too intensively, with the result that the soils become subject to excessive erosion and declining fertility and they fail to absorb their share of precipitation. On the other hand some land may not be used intensively enough. While many, perhaps most, farmers follow some good agricultural practices, there are many practices which have been designed to conserve soil and moisture and so provide better crops, animals and stream conditions. These practices may be misapplied or, more commonly, not applied at all.

The purpose of a soil conservation project is to adapt the use of the land to its natural capabilities and to undertake measures which will check soil erosion and accelerated run-off of water, and help to maintain productivity at a high level. The real job of conservation farming is to make part of the farmer's routine all the practices necessary to preserve, improve and make good use of the soil.

4. How the Black Creek Valley was Surveyed

During May of 1955, several crews were engaged in the survey of Black Creek Watershed. Each crew was allotted a portion of valley and all the land was covered on foot with visits being made to every field.

During the survey a number of things were recorded, the data being plotted on air photographs of the area. These show the field pattern, the field boundaries, extent of woodlot and so on, and greatly facilitate survey work of this nature. All land uses for the crop season of 1955 were recorded on the photographs by means of appropriate symbols. In the same manner, physical land conditions were recorded to a minimum of four acres. These include the delimiting of soil types, an estimation of erosion, the slope of the land, the degree of stoniness or boulderiness, the location of stone piles, and extent and size of gullies. The locations and condition of all water bodies, watercourses, springs, and seepage areas were noted. A record was also made of fence types; on the Black Creek many stone fences exist and these, as well as stone piles, would be a problem in the development of conservation measures. Certain of them would have to be removed before some of these measures could be installed.

During the survey many farmers and others were interviewed with the object of obtaining more complete information on questions of land use, soil problems and capabilities, and surface water conditions.

With the completion of the survey, the information obtained was transferred from the air photographs to vellums and the various acreages assessed by planimetering. From the data gathered regarding present land use and physical land conditions the capability of the land was appraised. This is expressed in the map of Recommended Use which accompanies this report.

CHAPTER 2

ASPECTS OF THE PHYSICAL GEOGRAPHY OF BLACK CREEK VALLEY

1. Bedrock Geology

The area lies above the Niagara Escarpment which, in this region, has been largely masked by deposits originating in glacial times. Underlying the area are stratified rocks of Silurian Age - the dolomitic limestones of the Lockport formation (these are the hard, erosion-resistant rocks which are largely responsible for the continuance through time of the spectacular Niagara Escarpment), and the gray shales of the Rochester formation. The latter formation is found only along the southern and western fringes of the watershed, while the former is seen in only one or two places as outcrops where stream dissection has been deep enough to reveal it.

Apart from questions of well-water supply the bedrocks are of little importance and except for one or two cases the surface relief is unrelated to them. In many instances, however, the bedrocks have been important in contributing material in which the various soil types have developed. In most of the watershed soils, shale and limestone are the most important constituents of the soil parent materials. In both the Harriston and Dumfries catenas, for instance, the parent material is composed principally of dolomitic fragments, but it also possesses important amounts of shale. This factor is of some consequence in the development of the various soil types, the facility with which erosion will take place, internal soil drainage, and inherent fertility of the various soils.

2. Physiography

Physiographically the Black Creek Watershed may be divided into four separate units:

(a) the hummocky, steeply sloping, roughly sorted sands and gravels of the moraine along the southern portion of the watershed. Pontypool sandy loam has developed here.

(b) the smooth to gently sloping, well sorted sands and gravels of the spillway through which much of the main Black Creek flows. Relatively broad and flat terraces are common. Caledon loam is the dominant soil type.

(c) the smooth to moderately sloping, drumlinized till plain which occupies much of the northern half of the watershed north of the Caledon sideroad.

(d) the hummocky, moderately to steeply sloping till moraine found about Cons. III and IVE, mostly north of the Caledon sideroad. This morainic area separates the till plain into two portions, a western well-drained section in which Harriston loam is the dominant soil type, and an eastern section where the topography is gentle to smooth and soil drainage is restricted or poor. In this latter section the major areas of muck and peat on the watershed are to be found. The common soil type on the till moraine is the Dumfries loam.

Each of these physiographic areas is marked by a soil parent material which had a mode of origin distinctly different, and each type of material has its own characteristics. As indicated, they may be divided on a broad basis into two categories: (1) till, (2) waterlaid deposits.

(1) Till

This material is formed under an ice sheet and consists of pulverized rock flour and angular stones of various sizes. Depending on the nature of the source rocks or unconsolidated materials, till may be either heavy, medium or light. Shales worked over by the ice would produce a heavy till, while sandstones would produce a light till. Tills are rarely uniform with respect to material content. While, for instance, shale may be dominant, there may also be included various amounts of limestone, sandstone, granite and so on. Under certain conditions of mixing a till may be classed as loamy.

Typically, a till plain presents an undulating surface of slight to moderate relief with many areas, often small, where drainage is imperfect to poor. Often the surface

has been moulded into flutings which run in the direction of original ice movement. Oval, whaleback hills, or drumlins, are common to till plains and their long smooth slopes may form the best of the agricultural land. Because of their susceptibility to erosion, however, they usually require some care in management.

The till moraine is similar to the till plain in material composition but usually the topography is more tumbled, the slopes steeper, and the till itself coarser and much more bouldery. The till moraine is deposited at the rim of the ice, rather than underneath it.

(2) Waterlaid Deposits

This group consists of outwash materials deposited by meltwaters released during the stagnation or recession of the glacier. The deposits consist of sands and gravels and were laid down, in part, along the ice front as hummocky kames. The sands and gravels may be well stratified or only roughly sorted as is the case on Black Creek Watershed. In association with these deposits one may find inclusions of till or even silt or clay layers. Surface boulderiness may at times be a problem.

Where the meltwaters were voluminous they produced streams of some size. These often rapidly flowing waters in turn produced valleys of considerable size possessed of characteristic features. Such valleys are termed spillways and are marked by relatively straight courses, steep sides and flat floors which are frequently covered by layers of sand and gravel to some depth. Large amounts of these materials are being extracted from pits to the south of Caledon. Much of the course of present Black Creek is in such a spillway.

3. Soils

(a) The Soil Profile

The development of any particular soil is a matter which involves a number of variables, some of which may be of more importance than the others; type and composition of the parent material, surface slopes, soil drainage, and climate

may be cited as examples of some of these variables. In any single instance all of these factors operate together and interlock in such a way that, if undisturbed or unchanged, they produce, in time, a soil possessing certain recognizable characteristics.

If a vertical cut is made to a depth of three or four feet through the soil, it will be seen that the cross-section is marked by a layering, each layer, or horizon, possessing certain characteristics of colour, texture, structure, organic content, acid reaction and so on. Together these horizons make up the soil profile. The depth of the profile is variable, in some soils a foot or less and in others several or many feet. On Black Creek soil profiles are generally less than three feet in depth.

In this area two distinct kinds of profile are found, each representing what is called a great soil group. In the gray-brown podzolic group are found the good to imperfectly drained soils, while in the dark gray gleisolic group are found the poorly drained soils. Following are generalized descriptions of each type:

(1) Gray-Brown Podzolic Soil

Horizon

A_o - Partially decomposed litter from deciduous trees.

A_1 Dark grayish-brown to a very dark brown mineralized humus layer - loose and friable and slightly acid in reaction.

A_2 - The leached horizon, yellow to yellowish-brown to gray in colour. The iron, lime, organic matter and clay have been washed out and the reaction is acid.

B - The horizon of accumulation, containing a high proportion of clay and sesqui-oxides. Usually the colour is dark or reddish-brown while the structure is blocky or nutlike. In reaction it is usually neutral to slightly acid but the lower

Horizon

portion of the horizon may contain some free carbonates.

C - The unweathered, calcareous parent material, usually gray or brownish-gray in colour.

(2) Dark Gray Gleisolic Group

A_o - Partially decomposed litter from deciduous trees.

A_1 - Dark gray to nearly black mineralized humus layer; friable and granular or crumbly; slightly acid reaction.

G - The glei horizon; usually brownish-gray through to bluish-gray in colour; characterized by rusty specks or streaks which will be referred to as mottling.

C - The calcareous parent material.

In no case are the horizons separated one from the other by a sharp break; there is always a transition, in some cases greater than in others. Profile complexity also varies. In some instances not all horizons are represented, or they may be poorly developed. Also, the horizons vary considerably from soil to soil in thickness; some have a thin B, some have a thick B, and so on.

When speaking of soils the A horizons are considered to be the topsoil, the B the subsoil, and the C the parent material. As plant material decays it is gradually incorporated into the A horizon by the action of earthworms, micro-organisms and so on. During this process of decay certain acids are formed and these are washed downwards by the rain. Partly as a result of this acidic solution, lime, iron, clay colloids, and organic matter are leached out and carried downward to be redeposited in the B horizon. The B, as a result, has a rather high clay content and is dark brown to reddish-brown in colour. Under cultivation several horizons may be mixed together to form an Ac (cultivated) horizon.

Under conditions of a fluctuating water-table near the surface a soil may be considered to be imperfectly drained. Such a soil may often have a thicker A_1 horizon because of the less rapid breakdown of the organic material and at the same time the A_2 or leached horizon may be less well developed.

Two other types of soil also occur on the watershed: muck and bottomland. In the case of the muck the drainage has always been so poor that normal soil development has been unable to take place. In many places standing water prevails through all or most of the year. The accumulated debris from generations of water-loving plants has led to the creation of a layer of organic material, sometimes several feet thick.

Bottomland is found along the stream courses where periodic inundation takes place. This flooding leads to deposition of various mixtures of sand, silt, clay and gravel. Soil drainage is usually imperfect to poor and soil profile development is most often non-existent.

(b) The Soils of the Watershed

The soils of the watershed have developed on parent materials deposited during the last ice age. As already indicated, these range from roughly sorted sands and gravels through to medium tills.

A group of soils developed on the same type of parent material and possessing similar horizon development and characteristics is classed as a soil series. Except for texture, usually in the A_1 horizon, the soils within a series vary little one from the other. Thus there is Dumfries loam and Dumfries sandy loam. Dumfries indicates the soil series and Dumfries loam the soil type, loam being the textural classification. Soils mapping is usually done on the basis of the soil type.

Where soils series have developed on similar parent materials but differ in profile characteristics, then classification may be done on the basis of the catena. In terms of drainage there may thus be three series in the catena; the well-drained, the imperfectly drained, and the poorly drained members. In the Harriston catena the Harriston series is the well-drained member, the Listowel series the imperfectly drained member, and the Parkhill series the poorly drained member. For convenience a catena is usually identified by the name of the well-drained member.

The soil types mapped on the watershed are shown in the following table:

4. Soil Description

(a) The Dumfries Catena

The Dumfries loam is an important soil type on the watershed, about 18 per cent of which is covered by this type. The Dumfries sandy loam, which differs from the Dumfries loam chiefly in having a sandier topsoil, occupies much less acreage. For practical purposes the two may be considered as one. Both are marked by a highly irregular surface with steep slopes. Under conditions of cultivation or overgrazing erosion may be serious; many of the steeper slopes have had all of the topsoil removed. Surface boulderiness is no longer a cultivation problem over most of this soil, the boulders having long since been removed to the many stone piles and fences which are an important feature of the landscape, but surface stoniness is, in many cases, definitely a problem. By and large surface stoniness becomes acute where sheet erosion has been most severe; the finer materials are carried off by the water and the heavier stones are left. In many instances the soil surface has the appearance of a stone or gravel pavement.

The Lily loam, the poorly drained associate, is found in the many small low-lying areas. Mostly these are too small to map, except on a farm plan basis. Some sections

TABLE I

Parent Material	Catena	Series	Type	Drainage
Coarse, open limestone shale till	Dumfries	Dumfries	Dumfries loam	Good
			Dumfries sandy loam	Good
		Lily	Lily loam	Poor
Medium-textured loamy, limestone and shale till	Harriston	Harriston	Harriston loam	Good
		Listowel	Listowel loam	Imperfect
		Parkhill	Parkhill loam	Poor
Well sorted gravels	Caledon	Caledon	Caledon loam	Good to excessive
		Gilford	Gilford loam	Poor
Poorly sorted sands	Pontypool	Pontypool	Pontypool sandy loam	Good to excessive
Well sorted sands	Brighton	Brighton	Brighton sandy loam	Good to excessive
Usually lacustrine materials, or till	Muck and peat soils			Very poor
Stream-laid sands, gravels, clays or silts	Bottom land			Wide range, usually imperfect to poor

A tabular breakdown of the acreage of each soil type follows:

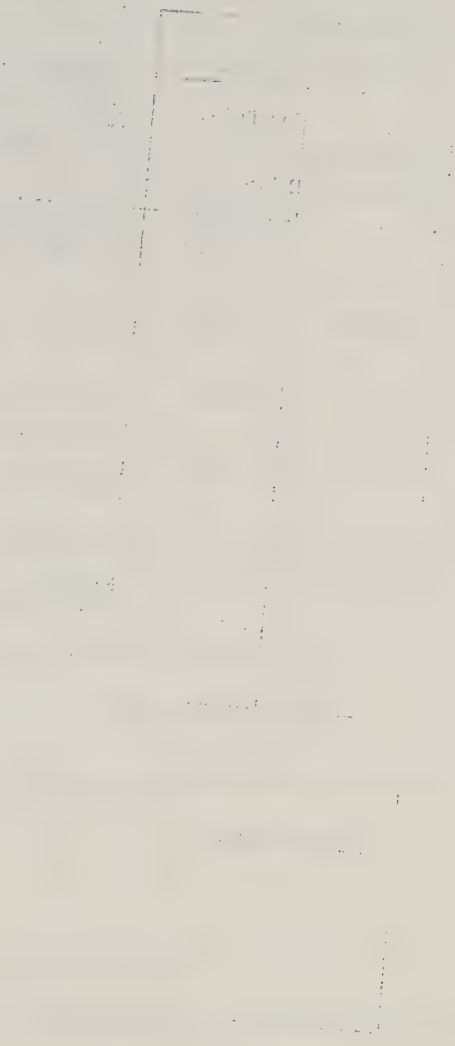

TABLE II

	Soil Type	Phase	Acreage		Per Cent (approx.)
I	(a) Dumfries loam		1,558		
	" "	Bouldery	13		
	" "	Stony	352	1,923	14.5
	(b) Dumfries sandy loam		401		
	Dumfries sandy loam	Stony	142	543	4.0
	(c) Lily loam		308	308	2.3
II	(a) Harriston loam		2,814		
	Harriston loam	Bouldery	17		
	Harriston loam	Stony	22	2,853	21.3
	(b) Listowel loam		1,301		
	" "	Bouldery	33	1,334	10.0
	(c) Parkhill loam		711	711	5.3
III	(a) Caledon loam		2,998		
	" "	Stony	39	3,037	22.8
	(b) Gilford loam		8	8	
IV	(a) Pontypool sandy loam		863		
	Pontypool sandy loam	Bouldery	900		
	Pontypool sandy loam	Stony	124	1,887	14.2
V	Muck			459	3.3
VI	Bottomland			223	1.7
VII	Water			83	.6
TOTAL				13,369	100.0

of the Lily loam might be drained with profit but generally their situation is such as to preclude measures of this nature. In certain cases farm ponds of the dug-out variety might be built in some of these locations.

The Dumfries is used largely for general farming and the open nature of the soil, resulting in a "warm" soil in the spring, encourages cultivation. The steep slopes, however, also encourage sheet erosion, especially when the cultivation is carried on irrespective of the slope. While the hummocky nature of the land makes difficult or impossible the use of erosion control measures such as contour cultivation or strip-cropping, long rotations should be used. Also, cultivation should be confined to the less steep areas. Most of the steeper slopes may be used to advantage for permanent pasture but grazing should be controlled. In some cases where the land has been cleared, reforestation would be the best use.

In general the Dumfries is a fairly deep soil, the very stony and bouldery calcareous parent material lying at a depth of 30 to 36 inches. The topsoil may reach to 17 inches, with a very dark brown loam lying over a fairly thick yellowish-brown leached A_2 horizon. The B horizon is dark yellowish-brown in colour and has a medium nut structure. Both A and B horizons are stony.

The Lily loam has a profile typical of the Dark Gray Gleisolic Great Soil Group and is also very stony. The very dark brown, loamy A horizon extends to a depth of about 6 or 7 inches and lies over a mottled, grayish-brown G (glei) horizon. The parent material is similar to the Dumfries.

(b) The Harriston Catena

The topography of these soils ranges from nearly level to moderately sloping. Steep slopes are uncommon but restricted drainage is a factor of considerable importance. Fairly extensive areas of Listowel and Parkhill soils are to be found in the eastern portion of the watershed. In most

respects the catena embraces the best agricultural land on the Black Creek. The land does, however, suffer certain defects.

The Harriston loam is well drained and contains a fair nutrient supply but the broad, smooth slopes are subject to sheet erosion if care is not taken in management. Many of these slopes are ideally suited to the use of special conservation measures such as contour tillage, but few, if any, of these are being used. Stoniness, while it does occur, is not a factor of great importance, particularly since most of the large boulders have long since been removed to stone piles or fence lines. In some cases the installation of certain soil conservation measures would imvolve the removal or burial of such stone fences but in most cases this would not be a major problem.

The Harriston profile is well developed and numerous good examples may easily be seen at road cuts. In some cases the profile is a little shallower than in the following description and, when fresh, the parent material tends to have a pinkish tinge.

The A_1 horizon is usually 5 to 6 inches in thickness, is dark grayish-brown in colour and has a fine granular structure. It lies over a yellowish-brown A_2 horizon which, in turn, at depths of 14 to 20 inches, lies over a dark brown, clay loam B horizon. The parent material is a stony, calcareous, pale brown loam dominantly limestone but with some shale.

The Listowel loam is developed on similar materials but the profile is less well developed and is not as deep. The slopes are gentle and smooth and erosion is not a problem. The chief difficulty arises from the imperfect drainage which serves to restrict the growth of some crops, particularly the "soil-building" legumes. Many small areas of this soil occur in depressions associated with the Harriston, but several large sections are to be found in the

eastern portion of the watershed. In most cases drainage is possible on these larger areas and would prove profitable.

The surface of the Parkhill loam is very gently sloping to level. There is no erosion and the profile is typical of poorly drained soils. The very dark brown topsoil ranges about 6 to 8 inches in thickness and lies over a mottled glei horizon. In most cases the drainage is too poor to permit the growth of crops and the land is usually devoted to woodlot.

(c) The Caledon Catena

The catena includes the well drained Caledon loam and the poorly drained Gilford loam. No imperfectly drained associate has been mapped and the acreage of the Gilford on the watershed is small. The topography ranges from near level to moderately sloping and is generally smooth. Although the parent materials are well sorted sands and gravels, surface stoniness or boulderiness is not normally any great problem. Erosion is usually mild but may be moderate on the longer and/or steeper slopes where adequate care is not taken. Because of the open nature of the material soil drought may be an important factor in some locations, but the maintenance of a high organic content in the soil may in part compensate for this. Partly because of the high degree of leaching, the Caledon loam is naturally somewhat low in the three main nutrient elements. Commercial fertilizer can be used to advantage.

On the Black Creek the Gilford occupies depressional areas and, generally speaking, is of little importance. Erosion is slight and poor drainage is the chief factor limiting use.

Much of the Caledon loam is used for general farming but an important use is the extraction of sand and gravel in the area south of Caledon.

The profile of the Caledon loam is relatively deep with a very dark grayish-brown A_1 horizon reaching to about 4 inches and yellowish-brown A_2 extending to about 20 inches. The B is a dark brown clay loam of coarse nut structure and it ends in the parent material at about 3 feet. The latter is a well sorted, calcareous sand and gravel. The whole profile is mildly stony to stony. Some profiles are sandier than others.

The profile of the Gilford loam is similar in many respects to that of the Parkhill loam. The chief difference lies in the type of parent material.

(d) The Pontypool Catena

Much of the southern portion of the watershed contains the Pontypool sandy loam, the only member of the catena recognized. The topography is moderately to roughly hummocky and the slopes are generally steep. Because of its open nature this soil is well to excessively drained. The soil warms rapidly in spring and can be used early for cultivation but with the onset of dry, warm weather it soon shows signs of drought. The maintenance of a high organic content, naturally low in this soil, is a must. Only a relatively small proportion of the soil is suited to cultivation and the balance supports pasture or woodlot. The numerous depressional areas are sites of ponds, some of which are non-permanent in nature.

In general erosion has not been serious, chiefly because the steep slopes have been clothed with a permanent vegetative cover. Erosion is usually greater on the more moderate slopes where cultivation is practised. In such areas erosion has taken place into the parent material on the knolls.

The permeable nature of this soil may also be considered a factor in reducing water wash. Because of the high degree of vegetative cover, wind erosion is not a problem.

The profile of the Pontypool sandy loam is relatively deep and is well developed. The A_1 horizon is about 4 inches deep and lies over a well defined yellowish-brown A_2 which extends to about 24 inches. The B is dark brown, has a medium nut structure and reaches about 34 inches. The parent material is grayish-brown, sandy and stony, and calcareous. The whole profile is sandy and may be nearly stonefree to fairly stony.

While the parent material of the Pontypool sandy loam is considered to be glacio-fluvial in origin, there is little doubt that a considerable amount of it as mapped on the Black Creek is a shale and limestone till. In some respects the soil development on this material is akin to the Dumfries sandy loam, but the problems of separating it from the Pontypool are many. Insofar as soil management is concerned, the two might easily be treated as one land type. No violence is done to the mapping in this instance by treating the whole as Pontypool.

As noted previously, surface boulderiness is common in some areas, but because the steep slopes limit cultivation anyway this factor is not too much of a problem. Such lands are being put to their best use - permanent pasture or woodlot.

(e) The Brighton Catena

The only member of this catena mapped was the Brighton sandy loam. The area mapped as this type is too small to be shown at the scale of the Peel County Report. This section, occurring adjacent to the Dumfries loam, is devoted to permanent unimproved pasture and erosion was insignificant. Statistically it has been included with the Pontypool.

(f) Bottom Land

The term bottom land connotes more a land type than it does a soil type and embraces the immediate valley lands to either side of a stream. In most cases such areas

are marked by a wide diversity of materials - clays, silts, sands and gravels - often well stratified, but exhibiting little or no profile development. Bottomland is subject to relatively frequent flooding and normally these lands are imperfectly to poorly drained. Most often their only possible uses are for pasture or woodlot. At times, in a dry year, a fair to good crop of grain or other crop may be taken off. This is feasible, of course, only where the bottomland has sufficient extent to make the effort worthwhile.

(g) Mucks and Peats

Mucks and peats are in every case a direct result of very poor drainage conditions operating over a long period of time. Through the centuries generations of plants - trees, shrubs and others - have added their remains until a thick layer of nearly pure organic material is built up. As often as not such areas are water-covered through most of the year; in any case water is never far below the surface.

Mucks may be considered to be those organic soils so decomposed that it is difficult or impossible to distinguish by eye the nature of the original plant material. The peats are usually coarser and no such problem exists. In colour both types are black but the peats often become browner with depth.

On the Black Creek most of the organic soils are rather shallow but some run over 3 feet in depth. Except with adequate drainage such soils are useless for most purposes and have retained a forest cover. While their fertilizing qualities are questionable such deposits would, no doubt, prove useful as a supplement to most farm manuring and this use would probably cause little damage with respect to water storage. Sand is the usual material found immediately beneath the organic layer.

5. Soil Erosion

Through countless ages wind and water erosion have gone on; mountain ranges and the continents themselves have been lowered once or several times by the process and the detritus carried out to sea only, in time, to be resurrected in the form of new mountain ranges or other broad land areas. Like all else in nature the land surface is far from stable.

Erosion such as this is normal in nature; thousands, perhaps millions, of years are required to lower the land surface a few feet. Except when a catastrophe of nature occurs to upset the balance of things such erosion is infinitely slow. It is called "geologic erosion" and the process of soil building is easily able to keep pace with it. While conditions remain the same the loss of a fragment of the soil is offset by an increment from below as the parent material weathers, releases its nutrient load, and is incorporated into the soil profile.

Under cultivation or grazing, however, this picture may be changed radically; the soil is cleared of its protective vegetative covering or the protection is reduced, cultivation is carried on up and down the slope and the job of surface water flow is made easier, and the soil structure is depleted and the organic content lessened or even destroyed completely. The result? - the soil built so patiently by nature over the centuries may be ruined or rendered less productive in a rather short time. In a field where the parent material is found at the surface it may mean that two or three feet of soil has been removed - all in a relatively short time. Such erosion is called induced or "accelerated" erosion. It is this erosion that the conservationist is concerned about.

Perhaps the most spectacular form of erosion in Ontario is that of gully erosion. This type may occur for a variety of reasons: run-off water may be channelled down

the slope of a cultivated field; overgrazed pasture may produce the same result; tile drain outlets may be inadequately protected; cattle always using the same path have often produced gullies. Erosion such as this is easily recognized in its advanced state but may not always be easy to deal with. At its start a gully may be insignificant but it can become large very rapidly. Small rills which are found on the slope of a field after a heavy rain and which can be covered over at the first cultivation are danger signals every farmer should heed. Where gullies have reached the stage that it is no longer possible to cultivate across them the farmer should obtain expert assistance at once to deal with them. The Conservation Authority can aid the farmer in this respect. Fortunately gully erosion is not a problem of significance on the Black Creek.

Wind erosion is, and has been in the past, important in some areas of Ontario. It is most significant on the lighter soils where these are inadequately protected by vegetation. Erosion of this type is of no importance on the watershed; the soils where it would likely occur are largely kept in a permanent cover of grass or trees.

Sheet erosion, the least spectacular of the three types, is found almost everywhere in Southern Ontario and the Black Creek Watershed is by no means immune. In many ways it is the most destructive of the three types; it usually takes place relatively slowly and a whole field may be affected. Often the land user is unaware that the process is going on but with each rainfall a portion of his inheritance is taken from him. Fortunately much of the land has suffered only mild to moderate erosion but it must be remembered that this has taken place in a little over a hundred years. Without preventive measures the next hundred years could see a serious worsening of the situation.

Erosion such as this is a cumulative process; as the topsoil is steadily removed the soil becomes increasingly unable to absorb precipitation and more of it runs off down the slope. The more water that runs off the more soil it carries. The valuable available nutrients on which the crops depend for growth and health and on which the farmer depends for crops are also removed. As the valuable topsoil is removed and the soil humus content becomes less the crops suffer because of a decreased amount of available soil moisture.

Sheet erosion may take place on any sloping soil but is often worse on the heavier ones. The open nature of the light soils normally permits more readily the penetration of water. Erosion, too, may be more serious on gently sloping land where the slopes are long and the water has a free flow. Steeper, more hummocky land may actually suffer less because the slopes are short. In many cases, however, erosion may have taken place into the parent material on the knolls.

Types of land use and methods of cultivation may also have great significance in the amount of erosion that takes place. Land kept under a permanent cover of grass or trees may erode very little. The same may be true on level lands, regardless of the form of use although, of course, fertility levels may decline unless management measures are adequate. Intertilled crops such as corn or potatoes afford very little soil protection and their cultivation should be restricted to the more level lands. Drilled crops, such as the grains, give more soil protection and impede run-off to a slightly greater extent. Land left fallow is, of course, completely unprotected.

6. The Estimation of Erosion

There are a number of ways of determining whether erosion has taken place, and the amount. The effect of erosion can easily be seen in poor crop response due to

drought. On slopes or knolls where the A and/or B horizons have been removed, the soil is less able to absorb moisture and the crop may be thin and weak. In these same areas the grayish parent material may readily be seen at the surface. A patch with an excessively stony surface may also be a sign of severe erosion and reflect the removal of the finer soil constituents. On the Black Creek this is common to the Dumfries loam and the crop response is usually poor in such places.

Where indications such as this are seen other evidence is also usually available: sediment may pile up at the bottom of a slope; soil may accumulate on the uphill side of a fencerow while the downhill side is cut away. At one point on the Black Creek 2½ feet of soil was found deposited over a layer of muck in the hollow. Erosion on the surrounding slopes was acute.

To get a more certain determination of the degree of erosion the soil profile must be examined. It is usually possible to find a good profile of a virgin or nearly undisturbed soil in old woodlots and along fencelines. Such a profile may, for instance, exhibit one foot of topsoil (A_1 and A_2) and two feet of subsoil (B). On an adjacent cultivated slope of the same soil type and on which erosion is suspected, there may be only 6 inches of topsoil over the subsoil. In such a case it would be fair to assume that something like 6 inches of topsoil had been eroded away. In another case one might find the subsoil exposed at the surface and the parent material (C) at a depth of only 12 inches. All of the topsoil and one-half of the subsoil, something like 2 feet of material, would thus have been eroded away.

If the recognition of horizons by colour or texture is difficult, a simple chemical test can be used to aid in erosion estimation. It has been shown that there are, characteristically, no free lime carbonates in the topsoil or

subsoil but that they do exist in the parent material.* A dilute solution of hydrochloric acid produces an effervescense when applied to soil containing these free carbonates. In the imaginary virgin profile mentioned above a fizz would be obtained at 3 feet at the start of the parent material. On the severely eroded site the same result would be obtained at 1 foot. If the surface soil effervesced it would indicate that all of the topsoil and subsoil had been removed.

7. Erosion on the Black Creek Watershed

It has been intimated that, in certain cases, the erosion factor is not so serious as might appear at first glance. It is, however, quite serious enough and every effort should be made to reduce the loss. The following table shows the acreages of the watershed affected by the various degrees of erosion.

TABLE III

Erosion Class	Acreage	Per Cent
0 - no significant erosion	2,311	18.4
1 - less than 1/3 topsoil removed	8,133	64.5
2 - 1/3 - 2/3 topsoil removed	1,613	12.8
3 - 2/3 topsoil and less than 1/3 subsoil removed	389	3.1
4 - all topsoil and less than 2/3 subsoil removed	106	.8
5 - all topsoil and 2/3+ subsoil removed	52	.4
	12,604	100.0

In addition 459 acres were classed as muck and 223 acres as bottomland.. No attempt was made to estimate erosion for these classes and in many cases they were receiving material eroded from the surrounding slopes, rather than losing it.

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* This is true of most of the Southern Ontario Soils.

It must be remembered that the above table recognizes average conditions. There are very many small areas where profile removal is complete and the parent material is exposed at the surface. It should also be remembered that, in the above classification, the amount of material removed will vary from soil to soil. One-third of the topsoil removed from one soil may involve much less material than one-third from another soil because of the difference in depth of profile.

8. Boulderiness and Stoniness

Boulderiness and stoniness of the soils are factors of some importance on the watershed. Land was designated as stony or bouldery only where it was considered that either would be a factor impeding cultivation. In certain cases, of course, such a designation is rather subjective, particularly with respect to stoniness, but where reasonable doubt existed the classification was not applied. As will be seen later, stoniness or boulderiness of the degree implied here is sufficient to downgrade land, often considerably, in the capability rating. Such land may often be upgraded through stone removal and some on the watershed is in this position. Indeed, some was not mapped as either, the stones or boulders having long ago been removed to fence lines or stone piles.

There were 679 acres classed as stony and 963 acres classed as bouldery. The breakdown of acreage according to soil type may be found in Table II of this report.

CHAPTER 3

LAND USE

1. Introduction

At the time the physical land conditions were mapped note was also made of the present land use. This was done as part of the basic inventory and to establish, if possible, which soils were preferred for, or restricted to, the growth of which crops. Such knowledge is a decided aid in establishing the capability rating, and subsequently the use recommendation, for each soil type or piece of land. The latter will usually contain more than one soil type; the scale of mapping renders impossible the delineation of each type and consequently some generalization has to be made.

2. Land Holdings

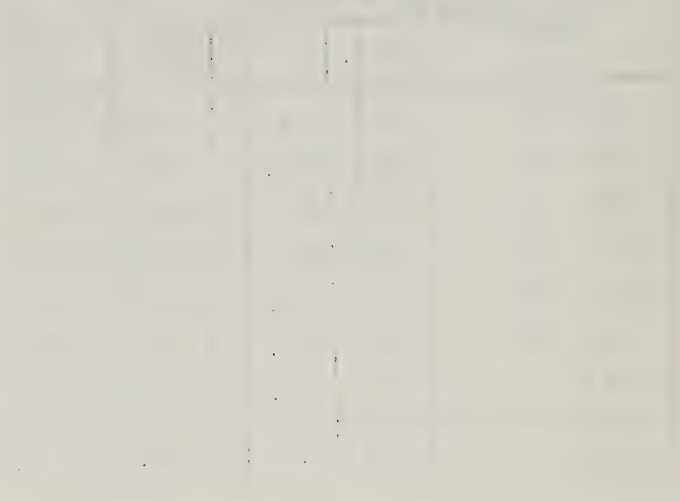
When the survey was made there were, apart from small, residential-type holdings such as those found in Caledon, 119 landholders on the Black Creek Watershed. The acreage contained by these holdings was 15,081. This figure is somewhat larger than that given as the watershed area and the discrepancy comes from the fact that the holdings were taken as whole units irrespective of whether or not the plot lay entirely within the watershed boundary. The average size per holding was 126.7 acres but the majority were smaller than this. The following table summarizes present conditions.

TABLE IV

Size of Holding (Acres)	Landholders		Land	
	No.	%	Acreage	%
10 - 25	5	4.3	74.0	0.4
26 - 90	16	12.8	869.7	5.8
91 - 110	59	50.7	5,888.0	39.0
111 - 150	13	11.0	1,894.5	12.6
151 - 190	8	6.4	1,353.0	9.0
191 - 210	10	8.4	1,991.0	13.2
210 +	8	6.4	3,011.0	20.0
Total	119	100.0	15,081.2	100.0

As may be seen from the above table, over half of the general watershed area is in units exceeding 111 acres in size. While much of this may be accounted for by amalgamation of land for agricultural purposes, some is being taken for the sand and gravel business. Outright purchase, or option, gives control of the gravel- and sand-rich areas and allows extensive long-term development to take place. At the present time sand and gravel is extracted commercially only from the parent material of the Caledon loam. A few small disused pits may be found elsewhere. The pits in operation to the south of Caledon are gradually increasing in size; the so-far unexploited lands around are still being used for agricultural purposes.

It is fully realized that these deposits, because of their situation and extent, are commercially very important. The present and future need for large well-situated deposits of this nature is well understood. The chief effect of these operations at this point would appear to be the removal of land from agricultural use. At the present time the acreage involved is small but in the foreseeable future it



is likely to become considerable. The future use of the area for agriculture is going to be very limited at the most. The actual use will depend on the condition in which the lands are left. It is recommended that the Authority establish liaison with the pit owners with the object of seeing to it that development and re-development of the land meet the best needs of all.

Although the watershed is not greatly affected at the moment it is to be expected that, as the metropolitan area to the south increases in size, there will be an alienation of land to residential building. Access to Brampton and the area to the south of that town is excellent and most of the building that takes place will likely occur along, or close to, No. 10 Highway. The effect of this on conservation planning should be watched.

3. Land Assessment

In 1954 the total land assessed within the Township of Caledon amounted to 68,321 acres and the value was $1,168,649. This represents a value per acre of $17.40, exclusive of buildings. The general watershed area, approximately 15,081 acres, was assessed at $245,106, or $16.25 per acre.

The lower assessment for the Black Creek area may be explained by the relatively low quality of much of the land. Nevertheless, some of these lands are carrying a fairly high tax load. The effect of this on the installation of conservation measures has not been determined.

4. Present Land Use

All of the land within the watershed was mapped according to its use during the crop season of 1955. The following table summarizes the use of the land at this time.

TABLE V

LAND USE - 1955

Use	Acres		Per Cent of Total	
Spring grain		2,254		16.8
Winter grain		44		.4
Intertilled crops - corn	20			
- potatoes	33	53		.4
Hay		1,853		13.9
Pasture - largely unimproved		6,390		47.7
Forest - not pastured	121		0.9	
- pastured	1,406		10.5	
- willow and other forest scrub not pastured	103		.8	
- willow and other forest scrub pastured	617		4.6	
- plantation	5	2,252		16.8
Gravel pits		39		.3
Water		83		.6
Residential, farm buildings, etc.		328		2.5
Fallow		73		.6
Total		13,369		100.0

The large acreage of pasture is in great measure explained by the considerable amount of poorly drained and steeply sloping, hummocky and droughty soils. By and large the use to which land of this nature is being put is its best use. In some cases, however, land conditions warrant reforestation.

Because of the roughness of the terrain or bouldery nature of the soil some of this pastureland cannot, economically, be improved very much. Some improvements such as weed clipping or fertilizing might, however, be carried out.

Much permanent unimproved pasture may be found on the imperfectly and poorly drained soils where little or no attempt at drainage improvement has been made. In most cases little has been done to plant one or more of the several

nutritious grasses suited to these conditions. Under improved management the stock-carrying capacity of such lands could be increased.

These permanent pasturelands also provide a source of sod for landscape work in the Toronto Metropolitan area. The individual plots where sod is taken are small and the total acreage involved is also small. Under present conditions there seems to be little harm in this form of use.

No particular attempt was made to determine the acreage of sod removal. The same applies to road allowances and farm lanes which, it is estimated, consume something like 400 acres of land.

The second significant aspect of the agricultural land use is the cultivation of spring grain almost to the exclusion of other crops apart from hay. The acreage devoted to winter grain is very small, as is that for corn. These crops reflect the minor interest in dairying and the emphasis on beef production.

Hay is the third important element in the rotation and 1,853 acres were devoted to this use in 1955. In many cases the rotation is a three-year one of spring grain, hay, pasture. Sometimes a four-year rotation prevails - two of spring grain, one of hay and one of pasture. In other cases two years of pasture are held.

Of the 2,252 acres classed as forest and forest scrub only 224 acres were not being pastured. Because of the pasturing the woodlots are not able to produce the quality or quantity of wood they should and adequate forest regeneration is unable to take place. Also, such land cannot carry as large a number of stock as open pasture. This does not mean, however, that such lands should be cleared to pasture. On the contrary! In most places the land is suited to little else and the woodlots should be protected and managed. The small amount and inferior quality of woodland forage can be more than made up by improving the pasture.

"Neither fish nor fowl" is perhaps the best description of the land cover classed as forest scrub. The use of every acre according to its capability is certainly not being made in this case. Where the land is needed for pasture and is suited to this use it should be cleared and managed. Where it is better equipped to produce trees it should be fenced and allowed to regenerate naturally or reforested by plantation. If some tree cover is desired for shading stock, a portion of the woodlot could be fenced on the pasture side for this purpose and the balance protected.

The relationship between soil type and land use may be seen in the following table. It will be noted that considerable simplification has been made in both categories.

TABLE VI

LAND USE RELATED TO SOIL TYPE

Soil	Hoe crops	Spring Grain	Winter Grain	Hay	Pas-ture	Forest and Scrub	Other	Water	Total
Harriston	16	801	28	545	1,220	110	133	-	2,853
Listowel	6	243	6	201	518	333	27	-	1,334
Parkhill	1	67	-	21	99	518	5	-	711
Dumfries	-	437	-	500	1,264	181	84	-	2,466
Lily	-	8	-	38	87	175	-	-	308
Pontypool	6	147	-	221	1,224	251	38	-	1,887
Caledon	24	536	10	300	1,809	213	153	-	3,045
Muck	-	12	-	8	20	419	-	-	459
Bottom-land	-	3	-	19	149	52	-	-	223
Water	-	-	-	-	-	-	-	83	83
Total	53	2,254	44	1,853	6,390	2,252	440	83	13,369

CHAPTER 4

LAND CAPABILITY AND RECOMMENDED LAND USE

1. Land Capability

Land capability means the suitability of a piece of land for a specified use. Many times this does not mean the soil, for soil and land are different concepts and the latter may contain a variety of the former. The capability of the land may be measured in terms of cultivation agriculture, grazing, horticulture, urban and industrial use and so on. In no two cases will the yard-stick used necessarily be the same. In the case of the Black Creek the land was considered from the point of view of its suitability to general farming.

In classifying the lands of the watershed several questions were kept in mind: (a) was the land suited to the production of crops ordinarily found there and if so could it be tilled without the risk of erosion; (b) if erosion was a restricting factor, how great a risk was entailed in devoting the land to continued cultivation; (c) was the land capable of being used for cultivation only part of the time with minimum risk; (d) was continued use limited to the production of permanent vegetation, and if so should the cover be grass or forest.

From this assessment of land suitability, which was derived from the information obtained as a result of the detailed survey of soil types, slopes and erosion, the present land use and the preference given on each soil type to various crops or use, the record of assessment and the experience of farmers in the area, a map of recommended use was made.* A copy of this map accompanies the report.

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* The "Guide for Making Land Capability Ratings from Soil Survey Data", published by the Ontario Soil Survey, Ontario Agricultural College was also used, as was the Peel County Soils Report.

CREDIT RIVER WATERSHED

BLACK CREEK VALLEY

RECOMMENDED LAND USE
ACCORDING TO USE CAPABILITY

USE CAPABILITY CLASSES

SUITABLE FOR CULTIVATION

I — WITH NO SPECIAL PRACTICES

II — WITH SIMPLE PRACTICES

III — WITH INTENSIVE PRACTICES

SUITABLE FOR LIMITED CULTIVATION

IV — WITH SOME SPECIAL PRACTICES

SUITABLE ONLY FOR PERMANENT VEGETATION

V — WITH SOME SPECIAL PRACTICES

VI — WITH MODERATE RESTRICTIONS

VII — WITH SEVERE RESTRICTIONS

RECOMMENDED MANAGEMENT

c — LAND REQUIRING EROSION CONTROL BY CONTOUR TILLAGE METHODS

d — LAND REQUIRING ARTIFICIAL DRAINAGE

e — LAND REQUIRING RESTRICTIONS IN USE
These apply only to classes II and III

s — RESTRICTED USE DUE TO ROUGH TOPOGRAPHY

w — RESTRICTED USE DUE TO INADEQUATE DRAINAGE
These apply only to class II

LAND UNDER EXISTING FOREST COVER

SCALE — FEET

SCALE — MILES

The suitability of the land for agricultural use is rated in four main categories:

A - Suitable for cultivation

B - Suitable only for occasional cultivation

C - Suitable only for permanent vegetation

D - Not suited to cultivation, grazing or forestry.

These broad classes have been subdivided as follows:

A - Suitable for Cultivation

Class I - without any special practices over and above good farming.

Class II - with moderate restrictions in use and simple, more specialized conservation practices.

Class III - with severe restrictions in use and intensive conservation practices.

B - Suitable Only for Occasional Cultivation

Class IV - best used for permanent vegetation but may be cultivated occasionally.

C - Suitable Only for Permanent Vegetation

Class V - with no special practices or restrictions.

Class VI - with some restrictions in use or special practices.

Class VII - with severe restrictions in use or special practices.

D - Not Suited to Cultivation, Grazing or Forestry

Class VIII - includes areas of rock outcrop and marsh.

2. Recommended Land Use According to Use Capability

These land use capability classes may be converted into classes of recommended use by indicating which special practices and restrictions are required for each type. The recommended classes are indicated by adding the symbols C, R or D to capability classes II and III, and T and

P to Class IV. On Classes V, VI and VII recommendations are given as needed. No special practices are required for Class I and normally no restrictions are placed on use.

The symbol C is applied to land where the capability has been reduced by erosion which can be corrected by mechanical means such as contour tillage, diversion terraces, strip-cropping or buffer strips. Land highly susceptible to erosion and capable of being farmed, using these methods, is also placed in this class.

Land whose surface varies from level to sloping but which is unsuited to contour tillage methods although subject to erosion, drought or fertility depletion, may be placed in class R. Vegetative methods of control such as rotations, winter cover crops and soil-building crops are indicated.

Wet land whose productivity can be improved by artificial drainage with minimum difficulty and expense is indicated by the letter D. Class IIID requires more intensive application than Class IID.

Class IV land which is too rough or eroded to be put under regular rotation is indicated as IVT. Land which is too wet for regular rotations and on which artificial drainage is not feasible because of lack of outlet is classed as IVP. Normally suited only to pasture, land of this class may, however, be cultivated and cropped in a dry year.

Land Class I

The land designated as Class I comprises only a little over 7 per cent of the land of the watershed. It is found on the well-drained Harriston loam where the slopes range from 0 - 2 per cent. A smaller amount is found on the Caledon loam. The areas indicated are almost free from erosion and the soils themselves are reasonably fertile. This class of land may be cultivated freely in any regular rotation, with no restrictions and no special practices over and above what is considered to be good farming, This means,

of course, fertilizing as needed, the maintenance of the organic content, suppression of weeds and so on.

Land Class IIC

About one-fifth of the land has been designated as Class IIC. As with the land of Class I, most of it is found on the Harriston and Caledon soils. Some of the smoothly sloping, little eroded Dumfries has also been so classified.

The slopes associated with this type of land vary from 2 - 6 per cent but are smooth and largely unbroken, and therefore suited to contour cultivation, strip-cropping and diversion terraces where applicable. Slight to moderate erosion has nearly always taken place.

Land Class IIR

This type is found on hummocky land with slopes ranging from 2 - 7 per cent; the nature of the terrain renders contour cultivation impractical. On the watershed most of this class, approximately 11 per cent of the area, is confined to the Caledon loam.

Erosion is mild to moderate and must be controlled by extended rotations, the use of winter cover crops and the restriction of hoe crops, especially on the more hummocky portions.

Land Class IID

Nearly all of this class is found on the level to gently sloping, erosion-free Listowel loam. Outlets are available and simple methods of field drainage are recommended. Often a single ditch would prove highly beneficial to crops or pasture. About 8 per cent of the watershed is of this type.

Land Class IIIC

This class, although comprising only 5.7 per cent of the watershed, is well distributed. It is found on the Dumfries, Caledon and Harriston soils where the slopes are steeper (6 - 10 per cent) or where gentler slopes have

been more severely eroded. The land is well drained and suited to contour methods of cultivation. Less than 6 per cent of the land is in this class.

Land Class IIIR

Most of this land is found on the hummocky Dumfries and Pontypool soils where droughtiness, infertility and erosion are problems. Small areas of stony, bouldery or eroded Harriston and Caledon soils were also placed in this class. Intensive restrictions in use are required to prevent more serious erosion and fertility depletion. Where erosion is already serious some land of this type has been placed in Class IV. The erosion and fertility depletion can be corrected by installing longer rotations and growing soil-building grasses and legumes. Land of this nature is not now being used for intertilled crops and there is thus no problem in this respect. About 10 per cent of the land is in this class.

Land Class IIID

This land class is mainly found on the poorly drained soils but also includes imperfectly drained areas in a few cases. Drainage is desirable but would be costly in that tile drainage is needed. The acreage involved is small and only 2 per cent of the watershed is so classed.

Land Class IVT

Land of this class should be restricted from regular cultivation because of susceptibility to erosion and rough topography. It is not good land for tractor work and sometimes stoniness or boulderiness is an added impediment. In some cases steeper, severely eroded, smooth, unbroken slopes were placed in this class. Their rehabilitation involves a definite program of improvement.

By and large, land of this class is best suited to beef production under a permanent grass cover. Occasional cultivation may be indulged in with reasonable safety, however.

Nearly 13 per cent of the land has been placed in this class. It is found on the Caledon, Dumfries and Pontypool soils.

Land Class IVP

This class is very limited on the watershed and is confined to those areas which cannot be feasibly drained. Generally they are restricted to the production of pasture but it may be possible to seed to a grain or other crop in a dry year. Erosion on this land is negligible; the chief hazard is poor drainage. About 1 per cent of the watershed is in this class.

Land Class V

Nearly 12 per cent of the watershed area is included in this class. It is found along stream bottoms but also includes fairly large areas of muck and other poorly drained soils where drainage is not feasible. In some places the land is clear and devoted to permanent unimproved pasture, but most of it is still under a cover of trees. It is unlikely that the benefits to be gained would be offset by the cost of clearing and such land would, therefore, be best left in trees. A number of these areas are found at the headwaters and act as water storage sites.

As with land Class IVP erosion is negligible, the chief hazard being poor drainage combined with periodic flooding in the bottomland areas. The land requires no special conservation practices apart from woodlot fencing and management, and some pasture management.

Land Class VI

This land is found on the steeply sloping, heavily eroded or excessively hummocky soils. Stoniness or boulderiness is often an added detriment. Because of their permeability some of these lands suffer from moisture deficiency in summer. The class is confined largely to the Dumfries and Pontypool soils. Most of the very hummocky, light soil area has suffered rather little erosion, chiefly

because it has been kept under a permanent cover of vegetation.

Because of the nature of the terrain and susceptibility of the soils to severe wind or water erosion, they should not be broken but maintained in permanent grass or trees.

About 8 per cent of the land has been classed as Class VI.

Land Class VII

The roughest of land, both hummocky and smoothly sloping, is included in this class. Where the soils have been cultivated or overgrazed erosion has been severe.

This land is unsuited to any form of cultivation and if left in pasture grazing should be severely restricted. In many cases, where woodlots are not already present, forest would be the best use.

In addition to the areas mapped as Class VII land there are many farms containing small amounts of this type. These were too small to map and, in most cases, they should be planted to trees.

Land Class VIII

Although several areas of this class are to be found on the watershed they were too small to map. For the most part the class comprises rock outcrops whose only possible use, apart from quarrying, would be as refuges for certain forms of wildlife. A number of small wet areas surrounding natural ponds which might be considered Class VIII land have been included with the designation "Water".

The following table summarizes conditions according to recommended use.

TABLE VII

Class	Acres	Per Cent
I	992	7.4
IIC	2,603	19.4
IIR	1,475	11.0
IID	1,070	8.0
IIIC	759	5.7
IIIR	1,354	10.1
IIID	293	2.2
IVT	1,700	12.7
IVP	156	1.2
V	1,571	11.7
VI	1,035	7.7
VII	278	2.1
Water	83	.6
Total	13,369	100.0

CHAPTER 5

CONSERVATION PRACTICES

1. Introduction

The fact that there is, comparatively, so little land on the Black Creek Watershed which can be considered Class I should be a point of concern to all those who are using the land. It should imbue them with a desire to see the great balance of the cultivable land used to best advantage according to its capability.

Contrary to the situation found in many places in Ontario the land is not, in most instances, being used too intensively. In some cases, indeed, it is not being used intensively enough. That is, for the same or little more labour the land could produce more, often much more, than it is, with no damage to the soil provided the proper, tested techniques are used.

By the use of methods which have been developed over the years by agriculturists and conservation engineers the lands of the valley could be made to produce more, and at the same time the soils could undergo structural regeneration and their fertility levels restored to, or increased beyond, the levels they were at originally. The improvement of soil - moisture relations is an important aspect of these techniques.

To obtain the most benefit and to ensure that the correct methods are installed in the first place, the individual farmer should consult the Soil Advisory Service, Ontario Agricultural College, through his local Agricultural Representative. Certain aspects may require technical advice from other agencies, e.g., woodlot management, on which aid can be obtained from the Zone Forester.

The actual application of the measures described in this report will, of necessity, be on a farm basis but they should be carried out with the planning of the whole area in

mind. The recommendations made here as to land use, as portrayed on the map, are not necessarily applicable to an individual farm. This map was not constructed with the object of planning farms. These recommendations will, however, provide the Authority with a firm base on which to carry out a program of little valley improvements and indicate where certain measures, as follows, could be used to best advantage. It must be remembered that the map of recommended use accompanying this report represents an end product after the weighing of many factors.

2. Conservation Measures

(a) Contour Cultivation and Strip-Cropping

Contour tillage means the adoption of methods whereby the land is cultivated along the contour and at right angles to the slope. Slopes so treated need to be broad and smooth, and the best installation of such measures may require the removal and/or relocation of one or more fencelines. When the land is tilled in this way each furrow or drill row acts as a small dam to retain the run-off water which is better able to be absorbed by the soil. Where shallow watercourses cross the slope they should be covered by permanent grass to form a grassed waterway.

Strip-cropping is often carried on in conjunction with contour tillage. This means the establishment of grass strips between the strips devoted to crop and they could be used for hay, for pasture in rotation, or for permanent pasture. By the use of such practice any water which escapes from the cultivated strip, and which carries soil with it, would be trapped by the grass.

Besides the benefits bestowed through reduction of water and soils loss, contour tillage offers greater ease and economy of operation of powered implements. If the strips are fairly long, turning has to be done less frequently.

Land suitable for such practice is pretty well confined to the Harriston and Caledon soils, where slopes of this type are common. Because the accompanying map was drawn largely without reference to roadlines, it is probable that the actual acreage suitable to these methods is smaller than indicated.

(b) Improved Pasture

A long-term pasture is one which is seeded to grasses and legumes and should, depending on conditions, last for a minimum of five years. The mixture used should be selected with a view to its suitability on the soil type.

Pasture should never be considered a "poor relation" in the farm economy; but unfortunately this is often the case. Frequently it is relegated to the poorest of land and little is done to increase its carrying capacity. The number of beef or dairy cattle or sheep that a farm may carry is directly related to the quality of the pasture. It is a major land use, not a minor one, and should be so treated.

It is true, of course, and this applies to the Black Creek, that certain lands are, without a prohibitive outlay in effort and money, incapable of being improved to any great extent. Nevertheless, certain improvements can usually be carried out and productivity increased. The line of improvement taken may vary according to the situation but could include the sowing of nutritious, adaptable grasses and legumes, a campaign of weed elimination, the addition of fertilizer (including lime where necessary) and planned pasture use to prevent under- and over-grazing.

Specific recommendations for the preparation and seeding of pastures can be obtained from bulletins distributed by the Departments of Agriculture and also from the

Agricultural Representative.* Soil tests and application of fertilizer are just as important as they are for any field crop or cash crop.

Management after seeding is very important in maintaining a high level of production and in ensuring that the best possible return is obtained from the expense of working, seeding and fertilizing. Periodic clipping produces a thicker turf and a more even stand, inhibits the growth of weeds, provides added protection to the soil and maintains the pasture in a palatable and nutritious condition. In addition to the direct application of manure or fertilizer, the pasture should be raked to spread out the animal droppings. This provides a more agreeable pasture for the animals and makes the best use of their droppings for fertilizer. Division of a pasture with electric fencing and the rotation of the herd is also useful in providing intensive grazing on one portion while the other is recovering its growth.

(c) Crop Rotations and Cover Crops

All of the cultivable land on the watershed should be managed using crop rotations suited to the needs of the individual farm. Carefully planned crop rotations, skilfully carried out, constitute a major soil conservation measure on the watershed; much of the land is unsuited to the installation of contour cultivation methods. A good rotation makes the best use of the soil and should be so designed that there is ample return of organic matter, either as green manure or as crop residue. The inclusion of legumes helps to build up the nitrogen content of the soil. Rotations should be

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* Useful bulletins include:

(a) Guide to Crop Production in Ontario. Ontario Department of Agriculture, Extension Bulletin No. 68.
(b) Hay and Pasture Mixtures for Ontario, Ontario Department of Agriculture, Circular 239.
(c) Better Ontario Pastures, Ontario Department of Agriculture. Bulletin 469.
(d) Fertilizers for Cereal, Hay and Pasture Crops. Ontario Department of Agriculture, Circular 144. (Rev. May, 1955)

worked out so that the land is kept under vegetative cover as much as possible. By so doing the soil is not so easily compacted and eroded by heavy rains or melting snow. Where it is planned to leave a field fallow it is advisable to cultivate so that much of the crop residue is left on the surface. This is particularly important with reference to the light sandy soils which are subject to wind erosion.

(d) Artificial Drainage

A considerable proportion of the land suffers from imperfect or poor drainage, either because of a poor outlet or because the internal drainage is slow due to the nature of the soil material or because the water table is high. In most cases rather little has been done to improve the drainage of those lands where it would prove worth while. In some instances ample relief could be obtained by simple ditch installation; in others more intensive measures would be required. Where ditches are installed they should be properly constructed and maintained to be effective. If tile is placed the outlet should be protected; many gullies have started from inadequately protected outlets.

Artificial draining of land of this kind is beneficial in a number of ways. Better growing conditions are provided for most crops and the productivity of the land is increased. Most commercial crops grown in Ontario prefer soils which are well but not excessively drained. If the drainage system is adequate and is properly maintained, the land will have a higher capability; it may be possible to grow not only better crops but a wider variety of crops. Land drainage also permits earlier spring seeding, enables more seed to germinate (a wet soil is a "cold" soil, and a "warm" soil is needed for the seeds to germinate and the plants to grow), makes the land more easily worked and permits more efficient use of machinery, reduces winter kill and helps reduce soil heaving and erosion. A cultivated soil saturated with water

is unable to absorb more during a heavy rain, and consequently erosion through run-off is a danger. When drained it is better able to absorb precipitation.

There are several questions which should be answered before a drainage work is begun. First, of course, is the question of whether the land is worth draining. The answer to this will depend on the nature of the soil, the ease of outlet and the use of the land when drained. There is also the question of which to install - open ditch or tile drain - and how much.

Any farmer contemplating a program of farm drainage is advised to read Bulletin 501, "Farm Drainage", published by the Ontario Department of Agriculture. Additional technical advice and assistance may be obtained through the County Agricultural Representative.

(e) Grassed Waterways and Diversion Terraces

While diversion terraces (i.e., broad, shallow trenches constructed across a slope to carry water safely to a disposal area) are a useful measure under certain circumstances, it is believed their possibility for use is limited on the Black Creek. In a few places, however, where the slopes are broad and long, they might be used advantageously.

The grassed waterway, a variant of the diversion ditch, occurs as a natural stream course and runs straight downhill. Often, in fact usually, such a channel is cultivated with the rest of the field and receives no protection. Under the grassing the channel course would be placed in permanent sod with the strip being wide enough to take care of any foreseeable water flow. The permanent sod reduces the erosive action of the rapidly flowing water and, if large enough, could be used as a source of pasture or hay. Grassed waterways greatly reduce the risk of gullying and they could be installed with benefit at many places.

(f) Woodland Management and Reforestation

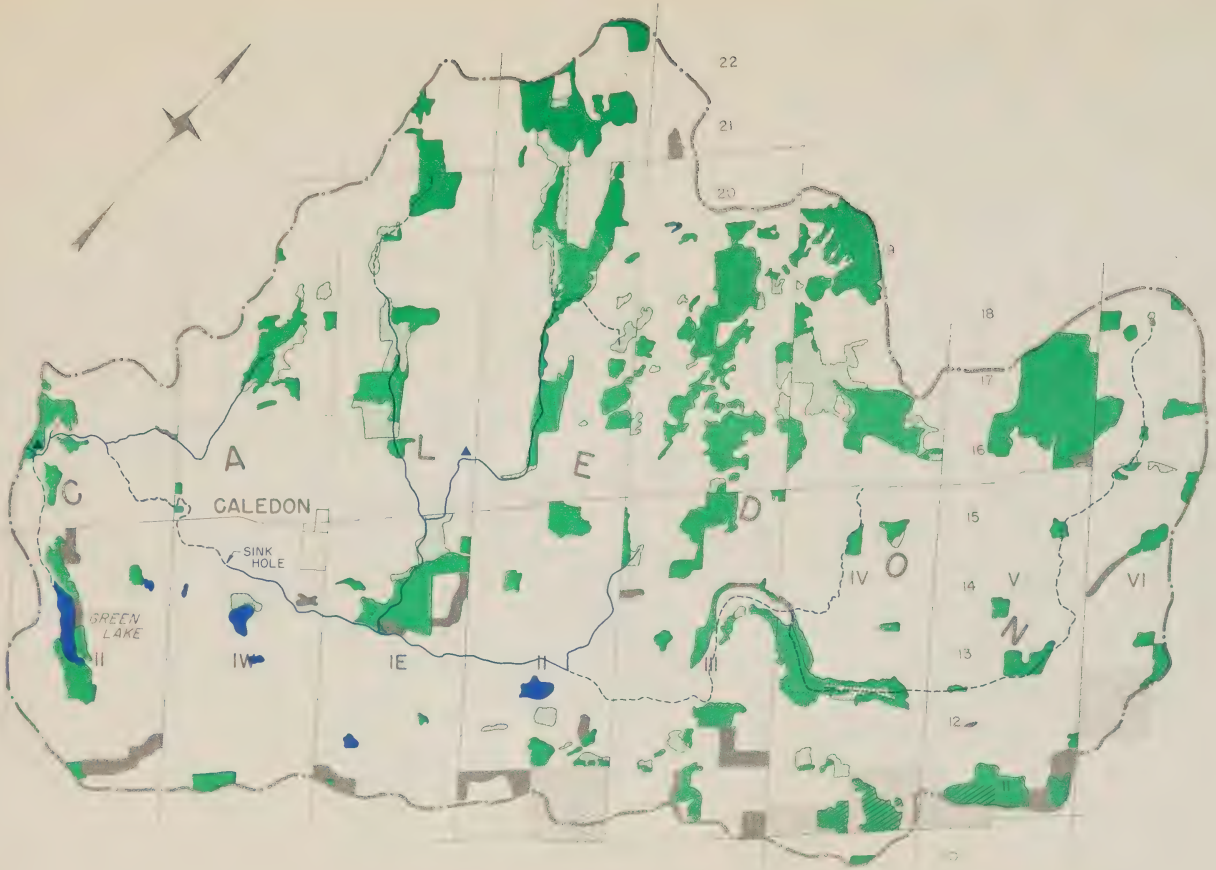
Protection of woodlands from cattle which now graze 90% of the forest land in the Black Creek area is obviously the most important need for improved forest management. A pastured woodlot is neither a good pasture nor a good woodlot. Following this elementary step, more intensive management would favour the better trees by eliminating diseased or poorly formed trees and trees of non-commercial species such as hawthorn and hornbeam.

The low percentage of forest cover on this watershed (11.4%) would be brought to a much more acceptable level by the reforestation of those areas designated as scrub (5.4%) and other small rough or wet areas aggregating 175 acres (1.3%) which should be reforested by individual landowners.

Only in the rough land along the south boundary of the Black Creek Watershed are there areas requiring forest cover in blocks large enough to merit public management. The 315 acres in this class are included in the areas which the Credit Valley Conservation Authority is advised to investigate for possible acquisition as part of an Authority forest.

(g) Stream Conditions for Fish

The forestry map shows the permanent water as indicated in a biological examination of the valley in 1954. All of the running water shown on the map was suitable for speckled trout so far as temperature is a critical factor. The volume of flow was extremely small and was listed as less than .25 c.f.s. at the junction with the main Credit River when examined in August, 1954. The water disappears in a sinkhole in the limestone at the point "A". Those parts of the stream not shown with a solid line are either standing pools or completely dry in summer, or else there may be permanent flow at a few points with the water disappearing underground after a short course.



CREDIT RIVER WATERSHED

BLACK CREEK VALLEY

SHOWING

RECOMMENDED AUTHORITY FOREST

AND

EXISTING WOODLAND

LEGEND

- RECOMMENDED AUTHORITY FOREST
- RECOMMENDED FOR PRIVATE REFORESTATION
- EXISTING WOODLAND
- SCRUB LAND
- SPRING
- WATERSHED BOUNDARY
- PERMANENT FLOW ----- INTERMITTENT FLOW
- SPECKLED TROUT COLLECTIONS

SCALE - MILES

1 ¼ 2 ¼ 0

Five species of fish were found in the stream. Speckled trout were caught at two points marked with an arrow on the map. Other species of fish which were generally distributed in the stream were: creek chub, which is common in the flowing water, and three species of no importance to anglers - the blacknose dace, the redbelly dace and the stickleback.

As the stream is of such small flow, it does not appear important to spend much time and money in attempting to improve it as an environment for trout. But it may be presumed that the improved land practices recommended in this report would have some effect in increasing the flow.

(h) Farm Ponds

Although the watershed is covered by a network of stream channels, and by much inadequately drained and swampy land, surface water supplies through much of the summer season are none too plentiful. In some cases, perhaps, little can be done to improve matters; for example, the porous, permeable soils of the spillway and kame moraine where drainage is practically all internal.

In the balance of the region the opportunities of doing something constructive are greater. Low, poorly drained areas can be easily and cheaply excavated to provide dug-out ponds. Some of the swampy areas of muck soils might also, under certain circumstances, be so treated. In all cases the ponds should be protected from trampling by livestock.

In some places run-off ponds, by-pass ponds and spring-fed ponds could be built relatively easily. In each case adequacy of construction is mandatory; Ontario is replete with dams which have failed through lack of appreciation of the factors involved. Several may be found on the Black Creek. A descriptive bulletin on farm ponds is available from the County Agricultural Representative. Assistance in laying out the pond may also be obtained from the Ontario Agricultural

College Engineering Service through the Agricultural Representative. Financial aid in pond construction is obtainable from the County.

(i) Stone Removal

While some 12 per cent of the land has been classed as stony or bouldery and an impediment to cultivation where such is possible, it should be realized that this figure is, if anything, on the conservative side. In many fields the formerly stony or bouldery condition has been cleared up but the stone piles and fences remain. Often the former are quite numerous and large and they often occupy valuable land besides offering a restriction to cultivation. The removal of stone piles to fence lines, or their burial, is a measure that could be adopted with profit. The Authority might consider giving assistance to those farmers wishing to improve their land in this manner and whose land so affected is worth such an improvement. Some of the Dumfries and Pontypool would be just as well left as is.

CHAPTER 4

A PROGRAM FOR A BETTER WATERSHED

Thus far in this report a number of things have been dealt with: the ideas of the little valley, of conservation, of geology, physiography, and soil, of erosion, of land use and so on. Certain recommendations have been stated or implied.

While an inventory of resources offers much to interest and is of value for itself alone, it is, of course, more valuable when put to use. It can help provide us with an answer to the question "Where do we go from here?". The effectiveness of any efforts toward planning a region such as the Black Creek Valley depend on the volunteer and co-operator to a large extent. The officers of the Authority must have the fundamental aid of this nature or their task is made unnecessarily difficult. None of us lives alone and there is a good deal of enjoyment and profit to be gained by mutual co-operation in a venture of this kind.

Although much of the work must and can be done by the individual farmer, community projects have to be done under the direction of the Authority. An example of the latter is the carrying out of a plan on a watershed basis. Such a project is beyond the individual. The planning of a farm, although requiring technical advice, is an example of the former in that once the farm is planned the onus of seeing it through to completion rests largely with the farmer. Where aid is required it is readily available - whether it be the installation of a farm pond, the fertilizer to use, the management of a soil or pasture, or some other aspect of farm land use.

On the map of recommended use a number of areas have been shown where the problems of soil conservation are few. Under normal good farming practice this land will long continue to provide good crops suited to the area. Any

program of Black Creek Valley development should see to it that these lands continue to be used wisely.

The large balance of the land suited to cultivation is unable, because of one or more factors, to produce crops without restriction except at a cost of damage to the land. Often the remedial measures required will be fairly simple; in other cases more intensive practices are indicated.

Probably without exception, each farm in the watershed contains several kinds of land in terms of capability or recommended uses. To get the most from his land that it is capable of producing, each farmer should have his land planned.* It would be well, however, if the Authority undertook to lead such a project, the Advisory Committee of which would come from farmers of the little valley concerned.

It should be recognized at the outset that a program such as this would be a continuing affair. Each farmer should be contacted personally by a member of the committee, the benefits to be derived from such a plan pointed out, and his co-operation requested. Periodically the progress made should be reviewed and the degree of Authority assistance made known. By acting as a body with a definite aim, the land-users and holders of the valley can accomplish a good deal; far more than by working alone. The results of co-operation such as this would be soon evident.

It would also be desirable if other groups interested in better crops and farmlands, such as Soil and Crop Improvement Associations and Junior Farmers, worked in co-operation with the Authority.

In the establishment of farm ponds, the planting of trees, relocation of fencelines, removal of stone piles and other such works it would be desirable if the Authority provided every assistance possible.

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* This may be done by application to the Soil Advisory Service, Department of Soils, Ontario Agricultural College, Guelph, or through the Agricultural Representative for the County.

The question of the removal from production of farmland through exploitation of sand and gravel has already been mentioned. It is necessary here only to emphasize that the utmost co-operation and liaison be reached between the Authority and the pit owners. Every attempt should be made to see that the land exhausted of its sand and gravel resources is returned to a usable condition as soon as possible. The use to which this land would be put would, of course, be dictated by the condition in which it was left. In any event, it would appear that it would be unsuitable for cultivation. The possibilities for recreational use should not be overlooked.